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THE ANALYST.

JANUARY, 1893.

PROCEEDINGS OF THE SOCIETY OF PUBLIC ANALYSTS.

The usual Monthly Meeting of the Society was held at the Chemical Society's Rooms, Burlington House, on Wednesday, December 7th, the President (Mr. O. Hehner), occupying the chair.

The minutes of the last meeting were read and confirmed.

The following gentlemen were proposed :—as Members, A. F. Morgan, F.C.S., Newport, Mon.; C. G. Moor, B.A., F.C.S., 101, Leadenhall Street, E.C.; T. S. Tweedie, Annan; —as Associate, J. F. Liverseege, F.I.C., Birmingham.

Messrs. G. Watson Grey and George Thomas Holloway were duly elected members of the Society.

The following papers were read and discussed.

"On the use of Crysotile Fibre in Proximate Organic Analysis."
By Thomas Macfarlane.

"On the Leffmann-Beam Process." Part II.
By H. Droop Richmond.

Mr. C. G. Moor exhibited some novel and ingenious forms of laboratory apparatus, consisting of a retort stand, a gas generator, a mouth blowpipe, and a chromic acid battery.

This concluded the proceedings of the Society.

VARIOUS PAPERS ON ABNORMAL MILK.

(*Read at the Meeting, November 2nd*, 1892.)

No. 1, by C. W. Heaton.

On August 9th, 1892, I received from the Inspector of the Parish of St. Martin's-in-the-Fields, a sealed sample of milk. He stated that his deputy had seen the milk

drawn that morning from the udder of a cow. The results of analysis were as follows :—

Specific gravity	1031·43
Solids, non-fatty	8·39 per cent.
Fat	·26 ,,
Total	8·65 ,,
Ash	·79 ,,
Chlorine in Ash	·20 ,
The cream separated in the lactometer was	1·00 ,,

The sample was, of course, obtained by partial milking, and according to law it could not be said to be adulterated.* Yet, what analyst, in ignorance of the facts, could possibly certify that such a milk was genuine?

This case seems to me to illustrate the inefficiency of the Food and Drugs Act in its present form. Surely, it would be better to insert in a schedule, the minimum strength which was to be held as representing genuine milk. The vendor could, of course, dilute or skim his milk down to this standard, but that is abundantly possible now. Milk below a certain strength ought not to be sold without special description.

It must be remembered that, to quote the words of the twelfth report of the Local Government Board, "the Sale of Food and Drugs Acts are not designed to prevent the sale of poor articles, but that of adulterated articles."

No. 2, by B. Dyer, Sc.D.

During the milking trials at the Essex Agricultural Society's Show at Harlow, this year, the writer met with a sample of abnormal milk which was of some interest. The cow yielding it was under four years old. She was milked dry on the eve of the show in the presence of the writer's colleague, Mr. Rosling. On the next morning she was again milked dry, and the morning milk was weighed and sampled for analysis. It weighed 16½ lbs. It was observed at the time of milking, that the cow was restless and nervous, and the attendant who milked her observed that she "held up" some of her milk. The milk when analysed gave :—

Total solids	10·85
Fat	1·85
Solids-not-fat	9·00
Ash	0·77

* It was decided, so far back as 1877, that milk should be sold "whole." A fine of £10 was inflicted in a case where the defendant had sold "fore" milk for genuine milk. (The Analyst, vol. i., p. 82). —S.-Edit.

On the afternoon of the second day, being curious to investigate further a case in which milk of such abnormal quality was yielded by a cow in good health and condition, the writer had her milked out again. This time the milk was normal and of good quality, shewing :—

Total solids	12·75
Fat	3·64
Solids-not-fat	9·11

The milk obtained at the trial milking was like partially skimmed milk, and it is to be presumed that the strange deficiency of fat was due to the " holding up " of the richer part of the milk. It is well known that the " strippings " are richer in fat than the main bulk of the milk, but not that so great a proportion of fat is liable to be withheld, as was the case here.

The main interest is centred in the fact that the cow normally yielded good normal milk; and the case serves to show that even an appeal to the cow may be sometimes misleading. Not only should a cow be milked " dry," but she should be milked carefully and without any unusual excitement, if a correct sample of her yield is required.

No. 3, by A. Smetham.

For several years past it has been the custom of the Altrincham Agricultural Society to award prizes at its annual show for the best cow for dairy purposes, and in order to estimate the relative merits of the animals exhibited, the judges have awarded points for the appearance (frame, etc.) of the cows, and have then left the final award to me, the award to be made by granting points for appearance of cow, quantity of milk produced and for the weight of the butter-fat and of solids-not-fat yielded during the trial.

This year four cows were entered for competition, and below I give the figures relating to each :—

No.	Weight of Mlk. lbs. ozs.	Total Solids. per cent.	Fat. per cent.	Ash. per cent.	Sp. Gr.
545	16 10	14·88	5·73	·68	1.0319
546	8 4	12·79	3·31	·80	1·0347
547	6 6	19·50	11·06	·53	1·0266
548	13 6	16·06	7·37	·72	1·0278

The cows were milked dry at eleven o'clock in the morning in the presence of the stewards, and they were again milked for the purposes of adjudication at 4 o'clock in the afternoon. It was the milk obtained in the second milking which I examined.

Although I was not present when the samples were taken I am assured that care was observed to prevent any tampering with the milk, and that, after weighing, the samples were immediately bottled in presence of the judges and forwarded to me. Indeed, the conditions under which the trials take place, practically preclude the

possibility of any tampering, for the milking is performed in view of the public as well as of the judges and stewards. It is also in the interest of each exhibitor to obtain as much milk as possible from his cow, as points are given for quantity as well as quality.

All the cows exhibited were shorthorns, but the only one which gave abnormal milk was the one numbered 547 in the catalogue. This was a three-year-old non-pedigree shorthorn, which had had her first calf three weeks before the show and had been liberally fed on a compound feeding cake and bean flour in addition to her ordinary rations. The milk marked No. 548 was from a cow which had had her second calf two months previous to the show, while that marked No. 545 was from a cow which had only calved one week.

In considering these results it must be remembered that the milk was obtained from four picked cows from one of the best dairy districts in England, and that the conditions of a show yard are not such as conduce to a normal flow of milk; but, nevertheless, they are interesting as showing within what limits pure milk from shorthorns may vary.

No. 4, by H. D. Richmond.

A sample of the evening milk from a farm in the West of England had the low specific gravity of 1·0300; this caused a suspicion of watering, but on analysis the figures found were :—

Specific gravity	1·0300
Total solids	12·32
Fat	3·70
Solids-not-fat	8·62

From that date for the succeeding five weeks a sample was analysed from every churn received from this farm.

The weekly averages are as follows :—

	Morning Milk.				Evening Milk.			
Week Ending.	Sp. Gr.	T.S.	Fat.	S.-N.-F.	Sp. Gr.	T.S.	Fat.	S.-N.-F.
Aug. 20 ...	1·0312	12·31	3·68	8·63	1·0298	12·64	4·07	8·57
„ 27 ...	305	12·30	3·84	8·46	297	12·56	4·18	8·38
Sept. 3 ...	310	12·47	3·91	8·56	303	12·90	4·41	8·49
„ 10 ...	310	12·59	3·92	8·67	306	12·75	4·15	8·60
„ 17 ...	305	12·30	3·68	8·62	302	12·94	4·26	8·68

Of the total of 160 samples, no less than 16 fell below 8·45 per cent. of solids-not-fat, and a further 14 fell between 8·45 per cent. and 8·5 per cent. of solids-not-fat.

The milk was supplied by a herd of 60 cows, who yielded an average quantity of 60 gallons a day, a very small quantity for the time of year.

On the 27th of August the whole of the cows were milked in the presence of witnesses, and samples were taken, as soon as the cows were milked, after the milk was cooled, and on the arrival of the milk in London; the analysis of these three series of samples differed only in the second place of decimals; the results were:—

	Sp. Gr.	T.S.	Fat.	S.-N.-F.
17 cows	1·0300	12·32	3·97	8·35
24 „	305	12·80	4·21	8·59
19 „	295	12·40	4·12	8·28

As these samples were strictly authenticated, and the possibility of water being added is precluded, I have no hesitation in accepting the other low samples as genuine; that they were so was further shown by the practical identity of the figures for milk-sugar, casein, albumen and ash in the authenticated and unauthenticated low samples.

The average of seven analyses during the week ending August 27th, was:—

Water	87·25
Fat	4·32
Milk-sugar	4·21
Casein	2·91
Albumen	·42
Salts	·77
	99·88

At the time when the low samples occurred, the cows were out to grass, and, owing to the bad season the pastures were extremely bare; I recommended an addition of saccharine matter to the food, and this was commenced in the week ending September 3rd, and in the week ending September 10th three samples were submitted to analysis with results as follows:—

Water	87·49	
Fat	3·91	
Sugar	4·43	
Albuminoids	3·40	(difference)
Salts	·77	
	100·00	

The average solids-not-fat had risen from 8·42 per cent. in the week ending August 27th to 8·63 per cent. in the week ending September 10th, or a rise of ·21 per cent.; the sugar had concurrently risen from 4·21 per cent. to 4·43 per cent., a rise of ·22 per cent.

Other samples from farms in the same district have been found as low as 8·4 per cent. in solids-not-fat, and a similar deficiency in sugar has been found.

In all the samples received from this farm the fat calculated by means of the milk-scale has been found to be about ·2 per cent. in excess of that actually estimated; a

deficiency in sugar, lowering the average density of the solids-not-fat, would partially account for this, but the difference is greater than would be due to the deficiency found. As Béchamp (*Comptes Rendus*, 1873, 2*d. Semestre*, 436) has described alcohol as a normal constituent of milk, I attempted to estimate this. After making 100 c.c. alkaline with baryta and passing a current of carbonic acid to remove the excess, I distilled 20 c.c. and found the density of the distillate to be 1·00005 and 1·00007 in two experiments; alcohol, then, if present at all is not in sufficient quantity to account for the low specific gravity.

Vieth (THE ANALYST xiv. 69.) has drawn attention to Recknagel's observation that the specific gravity of milk rises for some hours after milking, and has supplemented his researches; the average rise is ·0013; it is possible that this rise had for some reason not taken place in the milk from this farm.

From my analyses of milk this year, I can draw the following conclusions :—

i. During the months of June, July, August, and September of this year, the solids-not-fat have been fully ·1 per cent. below the average.

ii. This deficiency is due to a lowness in the amount of milk-sugar, and is probably attributable to the condition of the pastures due to the bad season.

iii. Authenticated samples have given as little as 8·28 per cent. of solids-not-fat (average milk of 19 cows); two unauthenticated samples having been lower than this, viz.: 8·22 per cent. and 7·92 per cent.

iv. During these four months the fat calculated by means of the milk-scale has been in excess of that estimated, the average of results (excluding this abnormal farm) has been ·07 per cent. too high. [This farm has been excluded as the great number of samples would destroy a true average.]

No. 5, by W. F. LOWE.

This milk was taken August 17th 1881, from a cow 9 years old and apparently in very good condition. The cow was milked in my presence and was milked dry, at the usual time of milking. The cow had calved at Christmas, and it was receiving a daily feed of Indian meal and cotton cake on coming up to be milked. The milk had an unpleasant saline taste, especially when cold. It yielded the following results :—

	I.	II.
Total Solids	8·82	8·83
Fat	2·84	2·73
Solids-not-fat	5·98	6·10
Ash	·93	·95
Chlorine in Ash...	·266	·268

The cow was some-time afterwards killed for food and was said to be healthy.

Discussion.

Mr. A. J. de Hailes drew attention to the results of analysis of certain samples examined by him. He had found

Specific Gravity	1026·00	1028·00	1026·50	1031·00	1031·50
Total Solids	11·90	11·33	10·27	14·54	13·98
Fat	4·17	3·45	2·80	4·77	3·92
Solids-not-fat	7·73	7·88	7·47	9·77	10·06
Ash	0·59				

In all these cases Mr. de Hailes stated he had seen the cows milked. He subsequently stated that he put them on the board because they were abnormal samples.

In reply to a question put by Mr. H. Droop Richmond, Mr. de Hailes stated that the gravity was taken with a specific gravity bottle.

Mr. Cassal thought that while the discussion was of undoubted importance to the Society, it went to show the necessity for the re-consideration by the council, or, perhaps, by the whole of the Society, of the definitions given to the articles dealt with by public analysts under the Sale of Food and Drugs Acts. Everything depended upon definitions. Mr. Heaton had contributed a note referring to what he called "poor but genuine milk." He (Mr. Cassal) would like to ask Mr. Heaton, Mr. Richmond, or any who made a speciality of milk analysis, what they meant when they said "genuine milk." The only definition with which he was acquainted was this,—that "milk is a liquid yielded by the lacteal glands of the cow." He did not consider that this was a definition which could possibly be accepted by scientific men. It ought surely to be obvious that the lacteal glands of a cow could be made to yield all sorts of remarkable liquids. By ill-treating a cow, by starving her, by improperly feeding or poisoning her, that cow could be made to yield various things, but those things were not milk. He had had samples of so-called milk, containing considerable amounts of pus and blood. Would Mr. Heaton say that a liquid consisting partly of pus and blood was "genuine milk" because it was extracted from the udder of a cow? He declined to accept the analysis of Mr. de Hailes, or analyses such as that of which Mr. Heaton had given details, as representing, in any sense, the composition of the article known as "milk," simply because it was alleged that the fluids analysed had been extracted from the udders of one or more abnormal cows. He invited the serious attention of the Society to the desirability of laying down a scientific plan upon which to work, based upon the many thousands of analytical results which had been obtained in reference to the natural product in question, and which showed its normal composition to vary between certain limits. It was well known within what limits natural milk varied and what was the "nature, substance, and quality" of that which the purchaser had a right to get when he asked for milk, and he contended that it should be laid down in any future Act of

Parliament relating to the adulteration of food, that, taking milk as an example, in cases where samples of so-called milk differed in composition from the well-known normal composition of milk, and were therefore not of the "nature, substance, and quality" of milk, it should be incumbent upon the person who sold these articles to prove that they had been produced in a legitimate manner. Rational definitions to be applied to other articles of food would also have to be agreed upon. The matter was one of vital importance.

Mr. de Hailes agreed with Mr. Cassal's remarks with reference to definitions. In his opinion there was no branch of trade in which such a rule of thumb method obtained, as in the milk trade. Everything that came from the udder of a healthy cow was called milk. Why should there not be two varieties of milk? The first variety could command the higher price, and the inferior could be sold at a lower price.

Dr. John Muter said he had always understood that, supposing a certain process were used—say the paper-coil process, or something which was known to be equally good—commercial mixed milk was a substance which should contain not less than $11\frac{1}{2}$ per cent. of total solids, and 3 per cent. of total fat. This seemed to him to be a very good definition of milk. He agreed with Mr. Cassal, and did not see that it followed, because an analyst occasionally received abnormal samples, that such definition should be affected. For one sample of an abnormal character (supposing all the cows in England were milked at one time), there would be thousands and thousands above the standard; the solitary exception only went to prove the rule. He objected to people bringing up extraordinary analyses for the purposes of defence in adulteration cases, as was occasionally done. A man, for instance, might go into Court and swear that he once analysed a so-called milk, or even two or three so-called milks, with extraordinary results; and he might give evidence for the purpose of defeating another public analyst who had worked on the recognised standard; and this, most unfortunately, was sometimes done. Instead of correcting blunders, such a man was trying to undo all the standards and to give milk dealers in England the power of adulterating milk to a certain extent, depending on the standard of abnormality. The Society should not take official notice of odd or abnormal samples. The question was—what were the constituents of average normal milk in England? He believed that the present standard of the Society could not be improved upon.

Mr. Allen concurred with Mr. Cassal and Dr. Muter. He thought that the figures brought forward in the various papers had a purely academic interest, since no public analyst would think of condemning samples of milk having the composition of the abnormal samples described. It had also been laid down very clearly by Mr. C. Estcourt, in a paper read some years ago before the Society, that the solids-not-fat should not be the sole criterion in judging of milk, but that other data should also be taken into account. From the point of view of the administration of the Act, the results recorded

by the authors of the paper were almost without significance at any rate, there was no fear of injustice being done to vendors. He thought that gentlemen who had found abnormal figures were quite justified, when called for the defence, in stating candidly that they had occasionally met with some samples of such composition which they believed to be genuine: but it was a pity that they did not go on to tell the *whole* truth, and say that such samples were of such rarity that the probabilities in favour of the milk in question being adulterated enormously out-weighed, by, perhaps, 10,000 to 1, the remote chance of its being genuine, and that the analyst who had an opportunity of examining the milk when perfectly fresh was more likely to be right than those who examined it at a later period. It was a great scandal that the Court should often be misled by evidence of the kind, and wrong-doers should consequently escape.

Mr. de Hailes, in reply to a question put by Mr. Alfred H. Allen, stated that the samples had not been taken from a herd of cows, but from single animals.

Mr. A. W. Stokes referred to the results of analysis of some milks yielded by a herd of thirty-one cows during three months.

The President asked Mr. Stokes whether he had any personal knowledge of how the samples were taken.

Mr. Stokes said he had not seen the cows milked.

Mr. Stokes thought, until some legal standard could be fixed, it was unwise to publish the results of confessedly abnormal samples. These were used in law courts as samples of genuine normal milks. Even in Dr. J. Bell's book on food not a single reference was made to the many hundreds of thousands of milk analyses made by other analysts on ordinary samples, but the pages of THE ANALYST have been ransacked to find every recorded abnormal analysis. It might be well for the Society to revise, in full committee, the present standards, and to invite all those who had experience of well-authenticated cases differing from the normal to detail them, but not for publication. There is a feeling in the trade, even by those who wish to raise the standard, that occasionally the innocent suffer.

Mr. H. Droop Richmond could not agree with some of the remarks made by Mr. Stokes, namely, that there was a general feeling in the trade that the standards of analysts were too high. Several representative meetings of the trade had been held, and the unanimous opinion expressed at these was that the standards of the Society of Public Analysts were too low; they admitted of a very considerable quantity of separated milk being mixed with and sold as genuine milk, a practice which was largely adopted by unscrupulous dealers; and the general sense of the meetings was that the standards should be raised, in order to prevent this fraud being committed. He (Mr. Richmond) worked with a high standard, and he found that nearly all his milks came up to it, and he made complaint in those rare instances in which they did not do so, with the result that the quality soon improved. He believed it possible that in the cases mentioned by

Mr. Stokes the cooler may have leaked, and this was possible without the knowledge of anyone. As Mr. Stokes had no means of satisfying himself on this point, his *very numerous* low samples could not be considered as authenticated, even if the reputation of a farmer were considered sufficient guarantee of the genuineness of milk which, perhaps, passed through half-a-dozen different hands. Such *genuine* low samples might suit the unscrupulous dealers before referred to, but they would not bear looking at from an impartial point of view.

Mr. Stokes remarked that if, as Mr. Richmond said, the cooler leaked, it only did so in the morning and never in the afternoon, through the three months' series of analyses.

Mr. Richmond drew attention to the fact that the low gravity of Mr. de Hailes' samples was an abnormality. He was under the impression that there was only one definition of milk—the *normal* secretion of the mammary glands of the cow. He thought some definition, such as the one he had given, which was a reasonable one should be inserted in the Sale of Food and Drugs Act. He also thought that a clause should be inserted to the effect that all milks below a certain composition should be considered suspicious, and the onus of proving the genuineness of such milks should be borne by the vendor, as had been previously suggested by another speaker. He would consider it sufficient proof of a milk being normal if the cows, milked on some convenient date, as soon after the samples were taken as possible, yielded milk below the Society's standard.

Mr. Alfred H. Allen said that in Manchester a system was carried out according to which, when a milk was found adulterated, the vendor was informed of the fact, and invited to allow an Inspector to visit his farm and see the cows milked, with a view to taking another sample of milk, and comparing it with that previously analysed.

Dr. Bernard Dyer said that the quotation of cases of abnormal milk should be of no use at all in defending cases under the Act. In bringing his note forward he did so as an illustration of what even a normal cow in normal health, under certain conditions might do, and to show that even an appeal to the cow herself might be fallacious or misleading if made under unusual conditions, as, for instance, if she were milked by strange hands or in presence of a group of strange witnesses.

Mr. E. J. Bevan thought it would be a matter of considerable interest if those gentlemen who had analysed such abnormal milks would tell the Society whether, in the future, if such samples came under their notice, they proposed to regard them as adulterated or not. It seemed to him that, as those gentlemen who were taking part in the discussion were speaking to a Society of public analysts and not one of milk vendors, such a question was not at all an improper one to ask.

Mr. Benedict Kitto said that his predecessor was sent a sample of milk one day and he returned it as having had so much water added. The Inspector believed the analyst

in that case to be wrong, because the farmer declared—and there were circumstances surrounding the case which showed the probable truth of the statement—that the milk was not watered. Of another sample sent after a short interval, the analysis was returned as being that of a very poor milk, but probably genuine. In the latter case the Inspector was tolerably certain that the milk was watered, because when he took the sample the man was reluctant to serve him, whilst in the former case it was just the reverse. The reason for the poorness of the milk in the first case given by the vendor in Court was that the cow had been affected by a blizzard, a period of most severe weather which lasted for 10 days or longer; and, after hearing Dr. Dyer's statements as to the great differences in the quality of the milk yielded on two successive days by a cow at a cattle show, he could conceive that this farmer's cow might have been so affected by the sudden blizzard that it gave an abnormally poor milk on this particular occasion.

The President remarked, as Mr. Smetham had very pertinently observed, an animal placed in a show, or under conditions that were likely to excite it, could not be expected to yield normal milk. He considered, therefore, that important conclusions could not be drawn from some of the samples referred to that evening. Dr. Dyer had given a very cogent explanation as to the reason for the abnormality of the milk which he had analysed, namely that the cow was excited, and yielded, on one occasion, exceptional milk. In Mr. Richmond's figures the differences from normal milk were so small that no cautious Public Analyst would have declared the samples to be adulterated. Not so, as regards Mr. Heaton's sample. He (the President) would have liked to have had full information concerning this sample. They knew only that it was sent by an Inspector, who stated that the Sub-Inspector had seen the cow milked. Coming to the results of Mr. Lowe it seemed evident that the cow was diseased. The ash was altogether out of proportion to the solids-not-fat, and Mr. Wynter Blyth had observed this in certain diseases. No doubt it was very interesting that diseased cows might yield such a fluid, but he could not see how this concerned them as Public Analysts. He would like to ask Mr. de Hailes in what condition were the cows, the milk of which he had referred to? It was an extraordinary thing, that in one single herd there should be so many cows yielding milk below the ordinary standard. Exceptional samples were undoubtedly sometimes met with that point had been agreed upon years ago—but exceptions surely were not so very common that from a herd of 30 cows many of the animals were found to yield milk of the nature described by Mr. de Hailes. Analysts had experience of immense numbers of milk and he (Mr. Hehner) could not but look upon the sudden appearance of so many abnormal samples with a great deal of suspicion.

He had already expressed his surprise at some remarks that had been made by Mr. Stokes. He thought that a Public Analyst who brought matters before them which affected both the general public, and the agricultural interests of the whole country, would most carefully weigh his remarks. He was astonished to hear Mr. Stokes bring

forward his results and then admit that the samples upon which the remarks were based were furnished to him by someone else who was, or might be, deeply interested in having these, to say the least, suspicious samples passed as genuine milks. They had from Dr. Vieth and Mr. Richmond the experience of the Aylesbury Dairy Company, where a process of considerable selection was going on, and they found that not one sample in 100,000 examined fell below, to any notable extent, the limit adopted by this Society; while Mr. Stokes asserted, that such exceptions were not only not rare, but frequent. By careful selection of the cows a great deal could be done, and he believed it was the duty of Public Analysts to teach the public and farmers to select their cows so that the public got a fair value for their money. It had been shown that if Public Analysts condemned milk with less than 8·5 per cent. of solids-not-fat, such milk disappeared from the market, and he believed, if they insisted upon 8·6 or even 8·8 they would soon get it, while if they always attached so much importance to the so-called lowest milk, they were not doing their duty to the public who had no one but the Public Analysts to advise them as to what milk ought to be. If a person purchased milk, he expected to obtain milk of fair composition and quality. The milk-consumer is distinctly prejudiced if the milkman sold milk containing only 8·0 per cent. of solids-not-fat. He refused to accept such a fluid as genuine milk. As regards other articles to which Mr. Cassal had referred, such as butter, he did not see how at present any definition of composition from a chemical point could be made. He could not see, with his present knowledge of the subject, how anyone who obtained a smaller proportion of soluble or volatile fatty acid in his butter was prejudiced, as the quality of butter did appear to be independent of the composition as regards soluble and insoluble fatty acids. He did not therefore think that a rigid definition of butter could at present be fixed upon. But in the case of milk the urgency for such a definition was very great. He thought Dr. Muter's remarks on this subject were much to the point. A limit by which milk should be judged had been carefully fixed by the Society and had since been confirmed by tens of thousands of analyses. It was certainly well for Public Analysts to know that there were occasional exceptional milks, but they should not help in depressing the limits upon the basis of occasional abnormal samples. For a Public Analyst to make the most of these abnormal milks, to hold them up as the milks by which the whole milk-supply should be judged and regulated appeared to him a grave scandal. Such persons were counteracting the good done by the general body of Analysts.

At the same time it should be distinctly understood that Public Analysts had absolutely no interest to get up cases against milkmen. Abnormal milks were the products of abnormal animals, and must always be considered in the light of their experience as exceptional and rare. They could be of no influence upon the mixed milk of herds of cows as sold by milkmen and used by the public.

The Analysis of Rubber Goods. R. Henriques. (*Chem. Zeit.*, xvi., 1892, 1595, 1596, and 1623, 1626, and 1644, and 1645.—The extreme difficulty of making a satistory analysis of rubber articles is well known, and the author has accordingly endeavoured to arrive at methods which, although not professing to solve all the problems presented, go a good way towards removing existing stumbling blocks. In the first place, the sampling of rubber goods is not easy to effect, as commercial articles are not homogeneous. For example, in a sheet containing much siliceous matter, at one place as little as 1·4% of SiO_2 was found, and in another no less than 28%. In the case of soft rubber goods, therefore, the sample must be cut into tiny cubes, and these well mixed, and fairly large quantities taken for analysis; while with hard rubber, division by means of a rasp is a convenient plan. The utility of an elaborate analysis of the ash of manufactured rubber has been much overrated, as on account of the alterations undergone by the mineral substances originally present during the process of incineration, the nature of these additions can with difficulty be deduced from the composition of the ash, whether obtained by simple incineration or by subsequent treatment with ammonium nitrate, carbonate and other reagents, designed to bring it into a uniform condition. The determination of the inorganic constituents of rubber is best effected in conjunction with the estimation of the total sulphur. Methods for the determination of the latter are numerous, but the author having tried the recognised dry methods and the plan of dissolving the rubber in an oxidising solution, such as nitric acid, has adopted a combination of the two. It is carried out as follows:—A small, but fairly deep, porcelain basin is covered with a funnel with a wide stem cut off short, and 20 c.c. of pure fuming nitric acid placed in it. Three to four grams of the rubber, cut into small pieces, are then gradually introduced through the stem of the inverted funnel, the operator waiting for the diminution of the reaction induced by each piece before putting in another. After solution has been completed, the dish is cautiously warmed on the water-bath, as a good deal of frothing may take place, the solution evaporated to a syrupy consistency, and the treatment with the acid repeated more than once if necessary. During the most violent part of the action of the acid the funnel stem may be covered with another smaller funnel, to prevent loss by spirting. Finally, to the concentrated solution is added 4 grams of a mixture of three parts of nitrate of potash and four of carbonate of soda, the whole warmed for some time on the water-bath and then fused in the basin, still covered by the funnel. Care must be taken that the melt be not too strongly alkaline, as otherwise the basin will be unduly attacked. When graphite is present in the rubber, prolonged fusion is inevitable in order to ensure its complete oxidation. The melt is treated with dilute hydrochloric acid, evaporated to dryness to render the silica insoluble, and taken up again with dilute nitric acid. Should the whole go into solution, it can be made up to a known volume, a portion taken for the determination of the sulphur, and the rest used for the estimation of the inorganic constituents of the rubber by the ordinary methods. In the contrary case, the residue can only consist of silica, barium sulphate and lead

sulphate. The latter is dissolved out with ammonium acetate, added to the main filtrate, and the analysis of the latter proceeded with as before. The silica and barium sulphate are separated by the usual means, and then, since barium sulphate has been recognized in the residue, the presence of barium in the filtrate will be a conclusive proof that the whole of the sulphur was left in the residue; and, *vice versa*, the presence of sulphur in the filtrate leads directly to the deduction that it cannot contain barium, and the work of analysis is by so much shortened. When the rubber contains little ash, and the total sulphur only is wanted, the quantity taken for analysis need not exceed 0·25 or 0·5 grms., and two evaporations with nitric acid, followed by fusion as described above, suffice. Carius' method is also available, but is, in the author's opinion, unsuited for the requirements of technical analysis.

Besides the total sulphur, it is important to know what quantity of the element is present as sulphur used for vulcanising, as distinct from that present as sulphides and sulphates. The process of dissolving the rubber in oil of turpentine has many drawbacks, and is, at the best, inexact. The following is the plan adopted by the author in its place. Commercial kerosene is shaken with caustic soda to remove sulphur compounds, dried and distilled, the fraction coming over between 140° and 250° being collected. 5 grams of the finely divided rubber, or 10 to 12 grams if it be low in ash, are placed in a weighed 250 c.c. flask, about 150 c c. of purified kerosene added, and the flask fitted with a condensing tube and heated in an oil bath to 140°, to 150°, CO, until the pieces of rubber have lost all coherence and the insoluble portion is left as a powder at the bottom. In order to make certain that the temperature has not been so high as to lead to the formation of sulphuretted hydrogen from the action of the sulphur on the kerosene, a second flask containing sulphur, and a similar quanity of the same kerosene, is heated in the same bath as the flask containing the rubber, and the evolution of sulphuretted hydrogen watched for by inserting a piece of lead paper in the neck. When solution is complete, the flask is put aside in a moderately warm place to allow the insoluble portion to settle, the solution poured through a weighed filter, the residue washed a few times by decantatation, brought upon the filter, and the flask washed out with hot petroleum, without special pains being taken to remove the whole of the insoluble matter from its walls. The washing is completed with petroleum ether of low boiling point, and the flask and filter dried together at 110°C. and weighed. There is now no difficulty in determining the amount of the sulphur in the insoluble residue and the form in which it is present, and this value deducted from that of the total sulphur already determined, gives the value for the free and vulcanising sulphur. One point needs notice. It is possible that when the mineral matter incorporated with the rubber consists partly or entirely of oxidising bodies, such as red lead, or of metallic oxides or carbonates, a portion of the vulcanising sulphur may become changed in the rubber itself into sulphates, the author having found small quantities of calcium sulphate in a rubber containing lead oxide and chalk. It is not possible to tell in such a case whether the calcium sulphate has been

added intentionally or has formed from the vulcanising sulphur. The residue from the petroleum treatment is also available for the direct recognition of the inorganic constituents of the rubber, it being practicable to recognise the actual compounds that have been used, instead of relying on a fancy apportionment of acids and bases from the result of a complete but undiscriminating analysis. The determination of the organic matter left undissolved by treatment with petroleum may be effected when the analysis of the inorganic constituents has been made, by heating a known amount of the total insoluble matter with sulphuric acid, and weighing the mixed sulphates, provided that the previous analysis has shown that no metal forming an easily decomposable sulphate is present. Should the inorganic matter be completely soluble in acids, that fact can be taken advantage of instead of the former method being used. This plan is especially useful when graphite is present, as it frequently is. Rubbers containing surrogate of one sort or another, may prove difficult to dissolve in petroleum ; but their case is provided for by the methods for the separation of surrogates (*v. i*). Organic admixtures, such as fatty oils, paraffin and asphalt, are readily soluble in petroleum, while those diluents of which cork and wood refuse are a type, do not seem to be used in modern rubber manufacture, and only drag on a precarious existence in text books. With regard to surrogates, scarcely anything more than a qualitative recognition of their presence has been hitherto attempted, in spite of their great commercial importance. They consist chiefly of the products of heating fatty oils with sulphur, or their treatment with sulphur chloride, although blown oils that are free from sulphur are also used. Rubber surrogates are generally yellowish elastic substances, which frequently possess a moist and oily feel.

Two samples on analysis gave :—

	I	II.
Water	1·00%	0·85%
Sulphur	6·17	6·40
Ash	5·51	0·80

The ash consisted of lime and alumina, together with a little oxide of iron and silica. After several attempts at estimating surrogates in the presence of rubber, including the use of various organic solvents and the application of the Hübl method, the author arrived at the conclusion that alcoholic alkali was the best reagent for the purpose. Direct experiment showed that it was capable of dissolving surrogate completely, and that it had but little effect on vulcanised pure rubber, other than that of removing the superfluous sulphur. The chief drawback to its use is its tendency to leave a certain quantity of alkali in the undissolved rubber, which cannot be washed out, and thereby increases the weight of the insoluble portion. Digestion of the insoluble rubber with an acid is not advisable, as it is not perfectly effective, and much complicates the analysis of the inorganic portion. The phenomenon appears to be due to the formation of an alkaline salt with the rubber substance. The ash in the portion insoluble in alcoholic alkali is

not, however, a direct measure of the amount of alkali that has been taken up by the rubber, as a part of it consists of sulphur as sulphate, so that it is necessary to determine the quantity thus present and correct back from SO_3 to S. The number and kind of estimations required may be gathered from the following analysis.

PURE VULCANISED PARA RUBBER.

Ash	2·80%
Total sulphur	9·50
Residue from extraction	95·55
Ash in residue (calc. on original rubber)	9·21
Sulphur in residue „	4·35
Sulphur dissolved „	5·15
Sulphur in ash „	1·25
SO_3 equivalent to sulphur in ash (calc. on original rubber)	3·10
Na_2O in ash (by deducting original ash and SO_3), (calc. on original rubber)	3·31
Corrected residue from extraction	92·24
Soluble portion { Sulphur	5·15
Soluble portion { Organic matter	2·61

The extraction with alcoholic alkali is carried out by digesting 3 to 5 grams of the sample, cut into small pieces, with about ten times its weight of alcoholic soda, for 6 to 8 hours under a vertical condenser. The solution is turned out into a basin, diluted with water, which causes only a trifling precipitation, and evaporated until it no longer smells of alcohol, filtered through a weighed filter, washed, dried at 100°C. and weighed. The ash of the residue is determined on about 1 gram, ammonium nitrate being used to ensure the complete oxidation of the sulphur present. The portion of rubber substance that goes into solution may well consist of small amounts of vegetable fats that exist in commercially pure rubber, and possibly of a little unvulcanised rubber which has escaped the action of the sulphur, raw rubber being stated to be more readily attacked by alcoholic alkali than the vulcanised substance. The last hypothesis is, however, not borne out by direct experiment, as it was found that raw rubber yields about the same amount of soluble matter as does vulcanised.

The process is applicable to hard rubber, but the extraction takes place less readily. The results of analyses, on the lines given above, of rubber containing surrogate are quoted. The compositions deduced for two samples are as follows :—

	A.	B
Caoutchouc	41·32	84·43
Surrogate	51·68	8 31
Sulphur	5·10	4·26
Ash	1·90	3·00

What proportion of the sulphur belongs to the surrogate, and what to the vulcanised rubber cannot be determined by the method used. The analysis of hard rubber can, as mentioned above, be effected by the use of alcoholic alkali, but the determination of the inorganic constituents by means of petroleum is not feasible, for hard rubber, unlike soft rubber, dissolves imperfectly therein. By substituting paraffin wax at a temperature of 300° C., solution can be effected, though there is a risk of loss of sulphur, and a certain amount of carbonisation is apt to take place if the temperature be unduly high. The author is engaged in devising methods for the discrimination of other rubber surrogates, such as fatty oils, paraffin wax, and asphalt.

B. B.

The Distillation of Butyric Acid. H. D. Richmond (*Staz. Sper. Ag. Ital.* xxiii. 5.)—The author disputes Duclaux's reasoning that the ratio between the amount of a solution of butyric acid which distils, and the acid contained therein, is expressed by a logarithmic formula; he gives the following formula $y = 2{\cdot}22x - 0{\cdot}0151x^2 + 0{\cdot}000031x$ (where x = the amount of distillate from 100 c.c. and y = the quantity of butyric acid contained therein); from this he calculates that, were all the volatile acid in butter butyric, the quantity distilled when 110 c.c. are collected out of 140 c.c. should be 96·3 per cent., and when 50 c.c. are collected out of 75 c.c., 89·1 per cent. Actual experiments conducted as in the Reichert-Wollny process give 96·9 per cent and 89·6 per cent. respectively, using only a butyric acid solution, and 97·2 per cent. and 89·7 per cent. when 4·4 grammes and 2·2 grammes of well-washed butter acids are added; the insoluble acids, therefore, exert no retarding effect on the distillation.

The ratio between Reichert-Wollny figures (5 grammes of butter taken, 110 c.c. distilled from 140 c.c.) and Reichert figures (2·5 grammes of butter taken 50, c.c. distilled from 75 c.c.) should be by the equation 2·167.

Experimenting on butters he finds the following figures :—

Ratio $\frac{R.W}{R}$ 2·23

Percentage distilled R.W 86·45

„ „ R 77·5

These figures differ notably from those required by theory; as the presence of volatile acids of higher molecular weight would cause the percentages to be higher than 96·3 per cent. and 89·1 per cent. and the ratio less than 2·167, he concludes that there is another volatile acid. He suggests the presence of lactic acid dissolved by the fat from the milk during churning.

H. D. R.

Some Analyses of "Cacio-Cavallo. G. Sartori. (*Staz. Sper. Ag. Ital.* xxii., 337.)—"Cacio-cavallo" is the typical cheese of southern Italy. It is to some extent

made in Lombardy, but the chief centres of its production are Agro Romano, Albruzzi Puglie, Calabria, &c.

As the chemical composition of this important type of cheese has not yet been studied, the author considered it desirable to obtain samples from different sources; of the different samples obtained, only two prepared at the Royal Agricultural School of Scerni, were considered typical. Of these, No. 1 was made with whole milk, and No. 2, with a mixture of separated milk with sheep's milk containing 8 per cent. of fat; the first was pale-yellow, and had a normal odour; the second was deeply coloured, and had a slight smell of the sheep.

	No. 1	No. 2
Water...	19·756	22·090
Fat	36·706	35·900
Total proteids	37·825	36·063
Ash (without NaCl)	2·340	2·640
Sodium Chloride	3·260	3·164
Total	99·887	99·857
Pure Proteids	34·125	35·573
Ammoniacal Nitrogen	·0616	·0503
Amidic Nitrogen	·665	609
Reichert-Wollny figure of the fat ...	25.30	28·71

The analyses were made according to the author's method for sheep's milk cheese (*Milch-Zeit.*, 1890, 51, *Annuario Lodi*, 1890); the pure proteids were separated according to Stutzer's method (ANALYST x. 75), with cupric hydroxide, and the nitrogen determined in the copper precipitate by Kjeldahl's method.

The author considers these results as only preliminary. H. D. R.

The Analysis of Steam Lard. A. Goske. (*Chem. Zeit.*, xvi., 1892, 1560 and 1597).—The author has had experience in the analysis of steam lard in the works of A. Schöndorff & Cie., and the result of his observations is to show the futility of attaching the extreme importance to the indications afforded by the determination of the iodine absorption which is given to this criterion by some chemists. The usual assumption that a lard which gives the right iodine absorption must, if sophisticated, have been doctored by the addition of vegetable oil, and that consequently the qualitative disproof of its presence suffices with the determination of the iodine number, to place the sample beyond suspicion, is erroneous, because the proper consistency is not given to adulterated lard by the addition of vegetable oil, but by the incorporation of lard oil. (Contrast the results obtained in the examination of American lard; the ANALYST, Vol. xiv. 32.) The

following mixtures, all free from vegetable oil, give figures that approximate to that yielded by normal samples of lard, which is taken by the author as 60 :—

Mixture.	Per cent.	Iodine number (calculated.)
Pressed Beef Tallow ...	10	60·5
Steam Lard	90	
Pressed Beef Tallow ...	5	58·25
Steam Lard	85	
Mutton Tallow ...	30	57·5
Steam Lard	70	
Pressed Beef Tallow	25	59·75
Steam Lard	45	
Lard Oil	30	
Pressed Beef Tallow	35	57·27
Steam Lard	25	
Lard Oil	40	

In these mixtures the iodine number of pressed beef tallow is taken as 20, that of steam lard as 65, of mutton tallow as 40, and that of lard oil as 85. The corrective influence on the iodine number of the addition of lard oil to adulterated lard, of course increases the lower the temperature at which the oil has been pressed, and the more triolein it therefore contains. Thus a lard oil pressed at 34° C. had an iodine absorption of 70, and one pressed at 16° C. one of 82·8, numbers approaching those given by most of the vegetable oils suitable for use in sophistication.

The author having disposed of the claims of determinations, other than that of the iodine absorption to be considered certain criteria, proceeds to give the method of examination he adopts. The solidifying point is taken by gently melting the lard in a basin floating on water at a temperature of 50°-60° C., pouring it into a wide test tube up to a fixed height, surrounded by a bad conductor of heat, and observing the highest point attained in the act of solidifying as in Dalican's method, a thermometer divided to 0·2° C. being used. Some examples are quoted which show that butchers' lard (*Metzgerschmalz*) has a solidifying point of 28·6 to 29·9, and that pure steam lard ranges from 24·9 to 27·1, while the sophisticated lards vary from 29·8 to 36·6, there being a general tendency of the latter to be higher than genuine samples. A suspicious lard, with a solidifying point above 28° C. is then examined for the form of the crystals of "stearin" obtained from its solution in ether. 1 to 1·5 of a gram of a suspicious sample, or 2 grams of a sample that has the proper solidifying point, are taken, dissolved in 10 c c. of ether in a test tube, the tube stoppered with a plug of cotton wool, and crystallisation allowed to proceed in a cool place for about six hours. As soon as a layer has formed at the bottom of the glass, but nowhere else, the supernatant liquor, which should still be quite clear, is poured off and replaced by a few c.c. of a colourless oil such as arachis or cotton seed, a

portion of the crystals picked out with a platinum loop, placed on a microscope slide and examined with a magnification of 300. The crystals first separating under these conditions are almost wholly beef stearin, and by their means as little as 5 per cent. of beef tallow can be detected. Mutton tallow does not crystallise so well, and 15 per cent. is the minimum quantity that can thus be recognised. The macroscopic aspect of the crystals is some guide to the adulterant present. Beef and mutton stearin form thick solid crusts, while lard stearin occurs in a looser state of aggregation. The microscopic appearances are equally definite. Beef stearin forms large tufts radiating from a common centre, the component needles being partly straight and partly curved. Lard stearin, on the other hand, though crystallising in tufts, is built up of plates instead of needles. The recognition of a vegetable oil is performed by the aid of the phospho-molybdate test, the nitric acid reaction and the rise of temperature with sulphuric acid. As beef tallow sometimes gives a blue or green colour with the first-mentioned reagent, like vegetable oils, it is necessary to test both the original lard and the oil expressed from it. Should the intensity of the colour be greater in the oil, it is clearly not due to the tallow. The same plan of separating the sample into a solid and a liquid portion, and testing both, is useful both for the nitric acid reaction and the rise of temperature with sulphuric acid. B. B.

Analysis of Lard. C. Amthor and J. Zink. (*Zeits. f. Anal. Chem.*, 1892, xxxi., 534-537.)—In the following table the extreme and mean values of the numerous analyses of new and old samples of lard, tabulated by the authors, are given. The samples were rendered by the authors from different individuals and at different seasons.

	New.			Old.		
	Highest.	Lowest.	Mean.	Highest.	Lowest.	Mean.
Melting Point of Fat	49·0	47·0	47·8	48·0	47·5	47·7
Solidifying Point of Fat	29·5	27·0	28·2	29·5	29·0	29·2
Melting Point of Fatty Acids ...	45·0	42·5	44·1	47·5	45·0	46·2
Solidifying Point of Fatty Acids ...	39·5	37·0	38·3	42·5	40·0	40·9
Iodine Absorption of Fat	52·7	50·0	51·4	51·8	49·2	50·2
„ „ Fatty Acids ..	53·4	51·1	52·0	49·9	49·4	49·6
Acetyl Number	5·7	5·3	5·5	—	—	—
Saponification Equivalent	195·6	194·2	194·9	—	—	—
Hehner's Number	96·1	94·7	95·4	—	—	—

It is also stated that 0·0012 mgms. of KOH are required to neutralise the free fatty acids in 1 grm. of the fresh fat and 0·0015 to neutralise those in the same quantity of the old fat.

The age of the fatty acids decreases their iodine absorption very considerably and, as

might be expected, exposure to air does so to a greater extent. Thus, a sample of fresh fatty acids gave an iodine absorption of 51·61 ; after 42 days in a closed vessel this had fallen to 46·10, and in an open vessel to 44·34.

The authors have their say in the controversy as to the conditions under which the iodine absorption of a fat should be determined (compare ANALYST, 1892, 199). They conclude that, for lard at all events, an iodine solution which has been kept (45 days) according to Hubl's original method is preferable, and that the alleged necessity for a large excess of iodine does not exist; constant results were obtained whether the iodine was 21·2 per cent. or 84 per cent. in excess, or between these values. A. G. B.

The Determination of Lime in Basic Slag. A. F. Holleman. (*Chem. Zeit.*, xvi., 1892, 1471-1472.)—The conventional methods for the determination of lime in phosphates are not perfectly satisfactory when the phosphate is rich in iron and manganese, as in the case of basic slag. Both Classen's and Jones' process leave something to be desired, but an accurate method can be got by combining the two. The plan devised by the author is carried out as follows:—

50 c.c. of the acid solution of the slag, corresponding to 1 gram of the original substance, are evaporated to low bulk, 20 c.c. of a solution of neutral potassium oxalate (1:3) added, and digested on the water bath with vigorous stirring until the precipitate is pure white and free from clots, a result usually attained in about ten minutes. The precipitate is filtered and washed with hot water until oxalic acid is no longer recognisable in the filtrate. The filter paper is then perforated, the precipitate washed through, and the last particles dissolved off with hydrochloric acid (1:1), in which liquid the bulk of the calcium oxalate is also dissolved, about 15 c.c. of the strong acid being required for the purpose. The solution containing the whole of the lime is evaporated to 25 c.c., 10 c.c. of dilute sulphuric acid (1:5) and 150 c.c. of 96 per cent. alcohol added. The calcium sulphate is filtered after standing for three hours, washed with alcohol, and ignited and weighed in the ordinary manner. The test analysis on known mixtures and on basic slag are quite satisfactory, the results being appreciably better than those obtained by either of the constituent methods used singly. B. B.

THE ITALIAN SOCIETY OF ANALYTICAL CHEMISTS.

A society under the above title has been formed, and the inaugural meeting was held at Genoa on Aug. 27th, for the purpose of electing officers, framing bye-laws, and receiving scientific contributions.

The provisional committee consists of Drs. Musso of Turin, Longi of Rome, Leone of Palermo, Guelfi of Genoa, and Alessandri of Pavia. H. D. R.

REVIEWS.

Traité General d'Analyse des Beurres. By A. J. Zune. 108, Rue de Rennes, Paris, 2 vols., 25 francs.

Eighteen years have elapsed since the first method, based upon chemical principles for the analysis of butter fat, was published. The amount of literature which has meantime been given to the world on this subject is enormous, and Mons. A. J. Zune has undertaken a meritorious and arduous labour in collecting it, two volumes amounting to 800 pages being the result. The collection is most complete, the author having in the great majority of cases consulted the original papers. Perhaps he has gone rather too much into detail, even every insignificant contribution bearing upon the subject being noticed by him, the result being that he gives 9 distinct modifications of the process for estimating the insoluble fatty acids, and 14 for estimating the volatile fatty acids, each one being honoured by the author with the title of a distinct *procédé*. Thus we have the *procédés* Hehner-Angell, Lechartier, Perkins, Reichert, Meissl, Munier, Caldwell, Allen, Crampton, Schmitt, Wollny, Mansfeld, Nilson and Sendtner, for the estimation of volatile fatty acids alone. The differences are often ridiculously small, and such as would suggest themselves to any intelligent operator, but M. Zune discusses and criticises them all with the utmost gravity. As a collection of work done on the subject, the work is most valuable, the author showing himself an acute and intelligent critic of work done by others. The same can hardly be said of his own original efforts to devise a method of butter-analysis. The method proposed by him consists in the saponification of 0·5 gramme of butter-fat with baryta under pressure, removing the products of saponification soluble in water, namely glycerine and the salts of butyric, caproic, etc., acids, together with the excess of baryta by means of hot water, the caprate and caprylate by petroleum ether, the salts of the oleic series with pure ethylic ether, and those of the palmitic series by boiling alcohol, the equivalent being determined in each case. Every practised chemist will see that this cannot possibly be done with accuracy upon half-a-gram of fat; nor are the solubilities of the salts in the various solvents employed sufficiently satisfactory for good work. The author himself does not appear to have worked the process, for not a single statement of its results is given; while in other methods he is profuse in such statements. Many chapters are devoted to the examination of butter-fat by physical means. The microscopical examination is very fully discussed, and many well-drawn figures are given, showing the appearance of various fats when crystallized from solvents, etc.; but although the author strongly recommends miscroscopical examination, his own plates and drawings do not appear to the reviewer to furnish a distinctive means of discrimination. There is an immense amount of padding in the work, and more or less irrelevant matter; but this may be forgiven an author who has been evidently determined to collect everything touching the analysis of butter. In this task he has well succeeded.

O. H.

The Coal-Tar Colours: with special reference to their injurious qualities and the restriction of their use. A sanitary and medico-legal investigation, by Theodore Weyl, with a preface by Professor Sell. Translated by Henry Leffmann, M.B., Ph. D. Philadelphia; P. Blakiston, Son & Co.

The existing information on the physiological effects of the coal-tar colours is largely the result of the investigations of the author, and chemists generally will welcome the appearance of the collected data in the English dress in which they are presented by Dr. Leffmann.

The little work in question is not restricted to a description of the poisonous characters of the synthetical colouring matters prepared from coal-tar, but deals also, in outline, with the methods employed for their manufacture and the chemical nature of the products. The laws in different countries relating to the use of poisonous colours, and the legal enactments concerning the use of such colours for the preparation of food, are fully set forth. Perusal of these sections shows forcibly the far more stringent regulations which exist in foreign countries, under which the colouring of "Demerara sugar" with a coal-tar dye, the nature of which was kept secret, would have been impossible. The injurious influence of the existing law of this country respecting experiments on animals is also brought into strong relief.

The typical reactions of the leading coal-tar colours are given at length, so that the analyst will usually be able to identify the substance with which he is dealing.

The book under notice deals with a number of important facts which have never received full recognition in any English work, and it will certainly be an indispensable addition to the library of the public analyst. The matter covers 150 pages, is well printed, and fairly free from errors. Dr. Leffmann deserves congratulation for his share in the production of a very useful volume.

A. H. A.

Olii Vegetali, Animali e Minerali (Vegetable, Animal and Mineral Oils). By G. Gorini. Second edition, by G. Fabris. Ulrico Hœpli, Milan, 1892. Price, 2 lire (1s. 8d.).

This little work is one of the well-known Hœpli Manuals of Science, Literature and Art. In this volume of 216 pages a large amount of information is given. It is essentially an elementary work, but most of the chief points in the chemistry and industry of oils are touched upon.

In the analytical part the leading characters, both physical and chemical, of the chief oils are given in tabulated form; in some cases, notably in the table of refractive indices, the limits are too narrow, but generally the information is correct and up to

date. A considerable amount of space is devoted to the discussion of the electrical conductivity of oil, which is later declared to be a method of little practical use for analytical purposes.

We are glad to see that the presence of sulphur in oils from the *cruciferæ* is not considered characteristic.

For determining the safety of mineral oils most importance is attached to the apparatus of Salleron and of Grainer; no mention is made of the Abel tester.

It is, perhaps, too much to expect in a work of this order to find mention of all the latest researches, but we think that the work of Hazura and of Benedikt, on the chemistry of oils, and that of Salkowski, on the detection of raw oils in cod liver oil, should not have been ignored.

This volume should be of great use to students and beginners, and though it lacks a comprehensive index, is greatly superior to the ordinary class of "technical handbooks."

H. D. R.

CATALOGUE OF SCIENTIFIC APPARATUS AND REAGENTS. Brady & Martin, Newcastle-on-Tyne.

This is a fairly full and complete catalogue of Chemical and Bacteriological Apparatus, as well as of that appertaining to other Sciences. It is printed on good paper, the numerous engravings of apparatus are very clear and distinct, and the whole is enveloped in a neat binding. Full and useful explanations are appended to much of the apparatus. Altogether, it is superior to the ordinary run of such catalogues.

CORRESPONDENCE.

Mr. A. W. Stokes writes us as follows :—"In a paper by Mr. F. T. Shutt, published in the December number of THE ANALYST (vol. xvii., p. 227), on 'The Babcock Method of Milk Analysis,' he states—'Mr. Stokes quotes *some* of my results, neglecting others, and entirely ignores my conclusions.' In this he refers to my paper in THE ANALYST, vol. xvii., 127. Mr. Shutt is in error; I did not quote a single line of Mr. Shutt's paper from '*Chem. News*, lxiv., 4.' I merely referred to the fact that Mr. Shutt does not find the Babcock method to give higher fats than reliable gravimetric processes. This reference occupied only two-and-a-half lines. The paper I wrote was not intended as a discussion on Mr. Shutt's paper. It is entirely different and altogether independent, as anyone may see by comparing the two."

APPOINTMENT.

The Town Council of the Borough of West Bromwich have elected Mr. John White, F.I.C., to the post of Public Analyst. Mr. White has been for several years chief Assistant to Dr. Bostock Hill.